

Section 3. Description of the Covered Species and their Habitats

3.1 SUMMARY

The six Covered Species occupy a wide range of stream reaches based on their specific habitat requirements and biological adaptations (Figure 3-1). In this regard, the Covered Species are dependent on a variety of stream habitats in the Initial Plan Area. Some larger streams may be used by all six species, while smaller tributaries may be used by all, some, one, or none of the Covered Species. A general description of the Covered Species and their habitats follows; a more detailed description of each of these species is provided in Appendix A.

3.2 SPECIES CHARACTERISTICS

3.2.1 Fish Species Characteristics

The four fish Covered Species are members of the Salmonid family. All four species exhibit varying levels of anadromy. Within the Initial Plan Area, chinook and coho salmon are exclusively anadromous, rainbow trout exhibit both anadromous (steelhead) and resident forms, and cutthroat trout mostly exist as resident populations, but limited anadromy does occur. Coho and chinook salmon are semelparous (individuals die after spawning), while rainbow trout (including steelhead) and coastal cutthroat trout are iteroparous (can survive to spawn more than once). Table 3-1 summarizes the key characteristics of the four covered salmonid species. A detailed description of each Covered Species is provided in Appendix A.

3.2.2 Amphibian Species Characteristics

The southern torrent salamander and tailed frog are alike in that:

- Both are found primarily in perennial watercourses and colder water relative to the salmonid species;
- Larval stages of both prefer riffle habitats that have clean cobble and gravel with minimal sediment accumulation;
- Both have limited dispersal abilities and are seldom found outside the stream or riparian strip; and
- Under certain circumstances, both can persist in streams with temporary periods of no flow or segments of subsurface flow during the late summer and early fall.

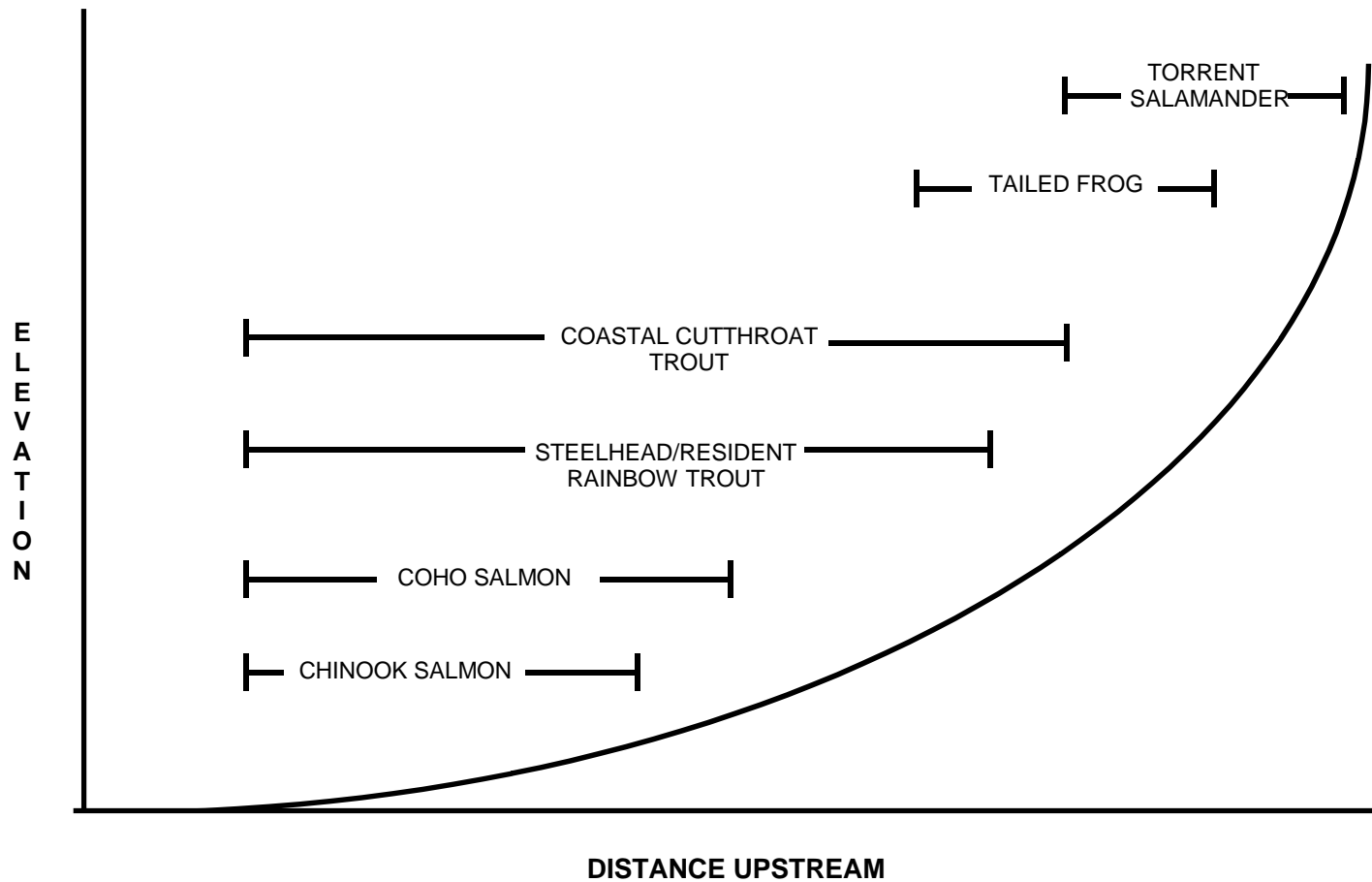


Figure 3-1. Schematic profile of the Covered Species distribution along a hypothetical stream channel.

Figure 3-1 is a generalized view of the distribution of the Covered Species within a hypothetical sub-basin in a coastal California watershed. The limits of each species' distribution in regard to channel gradient and distance upstream are not to scale, and smaller tributaries are not accounted for.

Table 3-1. Key characteristics of the fish Covered Species.¹

Characteristic	Chinook Salmon	Coho Salmon	Steelhead/Resident Rainbow Trout	Coastal Cutthroat Trout
Spawning Period (anadromous populations)	September to January, concentrated in Nov-Jan, depending on rainfall and stream discharge	• September to March, concentrated in Jan-Feb, depending on rainfall and stream discharge	• September to April depending on time of entry	• December to May depending on time of entry
Spawning Habitat Redd Sites Water Depth Water Velocity Substrate Size Temperature	<ul style="list-style-type: none"> • Pool tails or slightly upstream • 0.5 to 7 m • 0.2 to 1.9 m/sec • 1.2 to 10.2 cm • 5.6°C to 13.9°C 	<ul style="list-style-type: none"> • Pool tails or slightly upstream • 0.2 to 0.5 m • 0.3 To 0.5 m/sec • 1.3 to 15 cm • 5.6°C to 13.3°C 	<ul style="list-style-type: none"> • Pool tails, upper sections of watershed • 0.1 to 1.5 m • 0.2 to 1.6 m/sec • 0.6 to 12.7 cm • 5°C to 15°C 	<ul style="list-style-type: none"> • Pools tails with protective cover nearby • 0.1 to 1 m • 0.1 to 1 m/sec • 0.6 to 10.2 cm • 5°C to 15°C
Incubation Period	• 30 to 159 days depending on water temperature	• 36 to 100 days depending on water temperature	• 19 to 80 days depending on water temperature	• 40 to 50 days depending on water temperature
Rearing Habitat	<ul style="list-style-type: none"> • Fry seek cover in shallow water along channel margins or in low velocity channel bottoms • Overwintering juveniles seek shelter under large boulders and woody debris, and in side channels or other low-velocity refugia • Fry young-of-the-year and yearling smolts also use estuarine habitat • Summer weekly average temperatures (MWAT) below 17.4°C (NMFS recommendation for coho) 	<ul style="list-style-type: none"> • Mix of pools and riffles with abundant in-stream and overhead cover • Fry seek out shallow water along stream margins, backwaters, and side channels • Summer parr found mainly in pools. • Overwintering juveniles seek shelter from high flows in side channels, backwaters, under large boulders and woody debris • Summer weekly average temperatures (MWAT) below 17.4°C 	<ul style="list-style-type: none"> • Fry tend to school and seek out shallow water along stream margins • Larger fry and juveniles maintain territories in pool and run habitat • Summer weekly average temperatures (MWAT) below 17.4°C (NMFS recommendation for coho) 	<ul style="list-style-type: none"> • Fry seek out low velocity shallow water in stream margins, backwater pools, and side channels • Large coho fry can force cutthroat fry into riffles • Summer weekly average temperatures (MWAT) below 17.4°C (NMFS recommendation for coho)
Out-Migration (for anadromous populations)	<ul style="list-style-type: none"> • Downstream migration begins immediately after emergence (Late Feb –June) • Estuarine residence varies, probably 1-6 weeks depending on conditions. 	<ul style="list-style-type: none"> • Juveniles usually remain in freshwater for one year • Smolts out-migrate in late March to mid- June 	<ul style="list-style-type: none"> • Freshwater residence varies from 1-4 years, but 1-2 years is predominant in the Initial Plan Area. 	<ul style="list-style-type: none"> • Anadromous cutthroat smolt out-migrate at one to six years old depending on estuarine conditions.
Other Factors	<ul style="list-style-type: none"> • Chinook spawn at two to seven years old; in California, three to four year olds are most common. • Some males (Jacks) spawn at age 1-2. • All chinook die after spawning 	<ul style="list-style-type: none"> • Coho spawn after spending one to two years at sea; in California, most coho spawn at three years of age, with some males spawning at age 2 (jacks). • All coho die after spawning 	<ul style="list-style-type: none"> • Steelhead spawn after one to four years at sea • Adult steelhead may spawn more than once • Summer run steelhead are able to use habitat not accessible to fall/winter run salmonids • Resident rainbow trout and steelhead populations occur in the Initial Plan Area 	<ul style="list-style-type: none"> • Potamodromous and anadromous cutthroat use similar spawning habitat • Non-migratory cutthroat live in isolated headwater tributaries • Spawning tends to occur in 1st and 2nd order streams and isolated headwaters • Cutthroat trout may spawn more than once

Note

¹ For additional life history discussion and references see Appendix A, Section A-1.

They differ from one another primarily in that:

- Tailed frogs appear to have somewhat greater tolerances for increases in water temperature; and
- Springs and seeps are vital habitat for torrent salamanders but of limited value to tailed frogs.

Key characteristics of the two amphibian Covered Species Area are summarized in Table 3-2. A detailed description of both amphibians is provided in Appendix A.

3.3 HABITAT CHARACTERISTICS

3.3.1 Fish Habitat Characteristics

As described by Steele and Stacy (1994) and others, salmonids are highly responsive to changes in five variables: water supply, temperature, nutrients, LWD, and sediment. In this regard, the habitat is largely a function of the interaction of flowing water, sediment, and structures in stream channels and the adjacent riparian area. Stream channels encompass the area where water flows most of the time and the floodplain and former terraces above the bankfull channel margin that are sporadically inundated at higher flows. Along the river continuum from headwaters to lowland reaches, the terrestrial influences on the channel lessen as flow and sediment load increase and physical structures become less common (Murphy and Meehan 1991).

- Steep, headwater channels are tightly confined by valley walls and shaped by bedrock, boulders, LWD, coarse sediments, and riparian vegetation.
- Moderate to low gradient mid-reach channels are less confined and are shaped by bedrock, boulders, LWD, sediments, and riparian vegetation. At this point along the river continuum, the degree to which LWD forms and maintains channel features is often a function of gradient, with LWD-formed features more common in lower than steeper gradient reaches.
- Lowland reaches have channels which commonly meander freely across floodplains of fine sediments and are shaped by scour and deposition at meander bends. Pools are seldom strongly influenced by bedrock, boulders, or LWD.

Key interactions and variables of salmonid habitat are described below in terms of stream and channel features, riparian zone contributions, and other habitat factors.

3.3.1.1 *Stream and Channel Features*

3.3.1.1.1 Pools

Pools are formed either by local scouring or impoundment of the flowing water by structures such as bedrock, boulders, or LWD in or adjacent to the channel. During lower velocity flows, they are deposit areas for fine sediments, becoming shallower and wider as sediment inflow increases.

Table 3-2. Key characteristics of the tailed frog and southern torrent salamander.¹

Characteristic	Tailed Frog	Southern Torrent Salamander
Habitat Requirements General	<ul style="list-style-type: none"> • Cold clear streams with a boulder, cobble, or gravel substrate • Upper portions of streams but overlapping upper extent of fish-bearing reaches 	<ul style="list-style-type: none"> • Cold clear streams with a loose gravel substrate • Areas with water seeping through moss-covered gravel • Splash zones of waterfalls • Uppermost portions of streams and headwater seeps
Adults	<ul style="list-style-type: none"> • Streams and upland habitats along streambanks. 	<ul style="list-style-type: none"> • Interstices within gravel in streams and under objects along stream edges and in splash zone • Usually remain within 1 m of flowing water.
Larvae	<ul style="list-style-type: none"> • Attach selves to rocky substrates, primarily in riffles 	<ul style="list-style-type: none"> • Interstices within gravel in streams
Breeding Period	<ul style="list-style-type: none"> • Spring and fall 	<ul style="list-style-type: none"> • Spring or early summer
Metamorphosis of Young	<ul style="list-style-type: none"> • 1 to 2 years (data specific to Plan Area) 	<ul style="list-style-type: none"> • Probably 2 to 3 years
Forage	<ul style="list-style-type: none"> • Terrestrial and aquatic invertebrates • Tadpoles feed on diatoms 	<ul style="list-style-type: none"> • Terrestrial and aquatic invertebrates
Other Factors	<ul style="list-style-type: none"> • Predation by fish may limit distribution within lower sections of stream. 	<ul style="list-style-type: none"> • Can persist in streams with subsurface flow during the dry summer season • Generally are believed to have low dispersal capabilities
Note ¹ For additional life history discussion and references see Appendix A, Section A-1.		

Complexity of pool habitat (e.g., amount, size, and configuration of in-stream structures, water depth, sediment levels, and water velocity) affects the retention and cycling of nutrients within stream channels and the ability of some pools to sort and store the size of gravels required for salmonid spawning.

All salmonid species utilize pools at various life history stages. Pool abundance and depth has been positively correlated with salmon and trout abundance and density (Bisson et al. 1982; Murphy et al. 1986). For anadromous adult salmonids, pools provide protection from predators during spawning migrations and spawning activities. Protective cover for adult salmonids is provided by pools with depth and complexity, including undercut banks, LWD pieces, and LWD debris jams. Pools also are essential for juvenile salmonids such as coho salmon, steelhead, and coastal cutthroat trout that rear in fresh water for extended time periods. For such juveniles, pool habitats act as cool water temperature refugia in the summer and as cover from high flows in the winter (Steele and Stacy 1994). Pools with complex LWD jams provide juveniles year-round protection from predators and seasonal protection from high winter flows. Salmonid species with resident life histories such as resident rainbow trout and coastal cutthroat trout also require year-round pool habitat.

The following habitat type descriptions follow the descriptive language of the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998) unless otherwise noted.

3.3.1.1.2 Riffles

Riffles are swift flowing water with surface agitation with bars of deposited sediments that typically occur in areas of increased channel gradient. The upstream section of riffles (the riffle crest) forms a transitional zone between pools and riffles and is the area where hydraulic conditions initially sort transported sediments (gravel, cobble, and boulders). Riffles are important to salmonids because:

- Riffle areas produce a majority of the aquatic invertebrates consumed by juvenile and resident salmonids; and
- The substrates deposited at riffle crests are generally in the size range preferred by spawning salmonids, allowing them to use the upstream sections of riffles for redd construction.

3.3.1.1.3 Runs

Runs are typically areas of swift flowing water with little surface agitation and no major flow obstructions. The substrate composition of runs usually consists of gravel, cobbles, and boulders. The margins of runs are often utilized by young-of-the-year salmonids displaced by more dominant fish from pool habitats.

3.3.1.1.4 Side Channels

Side channels occur along stream margins or where water at elevated flows leaves the main channel and spreads over the floodplain. Secondary channel pools often form in side channels and extend beyond the average wetted channel. During low flows, side channels and pools are usually of little value to salmonids. However, in higher order

river channels (greater than fourth order), side channels and associated pools often provide thermal refugia for juvenile salmonids when main channel temperatures are high. Thermal refugia are formed when water from the main channel percolates subsurface through point bar formations and emerges as cooler water in side channel pools.

Side channels also provide vital habitat during elevated winter flows. For example, side channels formed by tree root systems and/or LWD offer protection from high flows that render the main channel inhospitable. The low velocity of secondary channel pools offers similar protection to over-wintering juveniles. In some instances, adult salmonids spawn in the tails of secondary channel pools that may remain more stable during flows at or above bankfull.

3.3.1.1.5 Channel Migration Zones

Channel migration zones are located in low gradient stream reaches with banks composed primarily of unconsolidated alluvial material whose form is controlled by a balance between flow regime and sediment supply. Within these channels, bank stability is maintained by the roots of riparian vegetation and by LWD that is large enough to remain stable during winter storms. In alluvial channels, the removal of riparian vegetation and excess sediment supply increases bank erosion and causes channels to become wider and shallower with decreased pool habitat.

Side channels often form in channel migration zones and provide quality fish habitat during high flows. Because these stream channels may migrate laterally in either direction during high flows, functional riparian zones should extend out to the valley walls to ensure proper riparian function for all potential channel locations.

3.3.1.1.6 Hyporehic Zone

The hyporehic zone is the interstitial habitat beneath the streambed that is the interface between surface water and the adjoining groundwater (Naiman 1992). In an alluvial channel or depositional reach this hyporehic zone can be relatively wide extending under point bars and into the adjacent bank as well as being several meters deep. In steeper transport reaches this zone would be proportionally less wide and much shallower, if not completely absent, due to bedrock control points. This zone provides interstitial habitat for numerous aquatically dependent species. Additionally, this zone acts as a regulator of nutrients to and from the surface water system depending on the flow conditions in-channel. Higher stream flows will recharge the ground water system as well as the hyporheic zone.

3.3.1.2 Riparian Zone Contributions

The riparian zone adjacent to streams (i.e., the corridor of distinctive soils and vegetation between a stream channel and the adjacent upland) is a vital component of salmonid habitat, providing temperature control, nutrients, channel stability, sediment control, and LWD.

3.3.1.2.1 Riparian Vegetation

In the coastal watersheds of the Pacific Northwest, riparian zone vegetation includes tree and shrub species such as alders (*Alnus* spp.), willows (*Salix* spp.), western red cedar (*Thuja plicata*), coastal redwood (*Sequoia sempervirens*), Sitka spruce (*Picea sitchensis*), Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), big leaf maple (*Acer macrophyllum*), and salmonberry (*Rubus spectabilis*). Their leaves, needles, stems, and branches provide shade that helps maintain summer water temperatures within the range required by salmonids. Leaves and other organic litter also are important energy sources to the aquatic ecosystem. In first and second order watersheds, for example, they provide more food for aquatic invertebrates than the organic matter in streams resulting from photosynthesis of aquatic plants (Murphy and Meehan 1991).

Riparian vegetation also aids in channel stability and in channel-forming processes. The root systems within the riparian zone stabilize channel banks and aid in the formation of undercut banks when the channel moves laterally and scours underneath the root systems. This undercutting often results in the recruitment of LWD to the stream channel. Riparian vegetation also may reduce amounts of sediment entering a watershed by intercepting the products of hillslope erosion.

3.3.1.2.2 LWD

Probably the most important function of the riparian zone is the production of large trees for recruitment as LWD to the stream channel. LWD is recognized as a vital component of salmonid-bearing coastal watersheds. The physical processes of LWD in watersheds include the formation of pools and other important rearing habitats, sediment control and storage, retention of organic debris, and modification of water quality (Bisson et al. 1987). The biological processes associated with LWD structures include barriers to fish migration, protective cover from predators and elevated stream flow, retention of gravels for salmonid redds, and regulation of organic material for the in-stream community of aquatic invertebrates (Bisson et al. 1987).

In coastal watersheds, LWD is responsible for the formation and location of many pools (Keller and Swanson 1979). For example, Keller and Tally (1979) and Keller et al. (1995) reported that 50% to 90% of the pools in the Prairie Creek watershed were formed by LWD. They also reported that some LWD had been in the stream channel for 200 years.

Depending on the size and location of the debris pieces, pools formed by LWD may be plunge pools, dammed pools, or lateral scour pools associated with a root wad or a log parallel to the stream channel. In first to third order streams, LWD often forms pools by a single piece fully spanning the stream channel. The single piece may entrain additional pieces of wood to form a stepped longitudinal profile (Bisson et al. 1987). In the smaller order channels, LWD that has spanned the channel as a whole tree will often be a stable fixture because even elevated discharges are unable to transport the debris downstream. As stream order increases, the magnitude and spacing of LWD clumps increases too (Bisson et al. 1987). In third to fifth order streams woody debris is often transported downstream during storms and is deposited on channel obstructions and on the outside of channel bends near the highwater mark.

Deposited LWD also has been shown to increase channel width, produce mid-channel bars and aid the formation of meander cutoffs and secondary channels (Keller and Swanson 1979). These debris deposits often result in short braided reaches and secondary channels that are important rearing habitat for juvenile salmonids in coastal watersheds (Sedell et al. 1984).

3.3.1.3 Other Habitat Factors

Other factors associated with salmonid habitat include water temperature, barriers to anadromy, and the importance of smaller watersheds.

3.3.1.3.1 Water Temperature

Water temperature can affect the survival, behavior, and metabolism of juvenile and adult salmonids (Bell 1973, Moyle 1976, Bjornn and Reiser 1991). Factors influencing water temperatures include stream flow and riparian cover. Low temperatures may inhibit growth by slowing fish metabolism (Chapman and Knudsen 1980), while high temperatures can cause direct mortality at temperatures of 23-25°C (Bjornn and Reiser 1991). The effects of elevated water temperatures on fish may be influenced by the range of daily temperature fluctuations, the duration of peak temperatures, acclimation, and the availability of lower temperature refugia (deep pools, undercut banks, and other in-stream cover) (Bjornn and Reiser 1991). In Mattole River coho were absent in streams with an MWAT (Mean Weekly Average Temperature) greater than 16.7°C (Welsh et al. 2001).

The reported upper limits of temperatures tolerable to the four covered salmonids vary depending on the measuring technique, species, and acclimation regime. Most published upper tolerance levels are based on laboratory experiments with fish acclimated to a constant temperature. Konecki et al. (1995) showed that juvenile coho acclimated to streams with summer temperature fluctuations had higher critical thermal maximums (CTMs) than fish from the same streams that had been acclimated to a constant temperature in the lab. This work suggests that fish in HPA streams (which have natural diurnal temperature fluctuations) may have higher critical thermal maximums than most published values.

Using one or several sets of water temperature values to establish biological objectives or thresholds is problematic because of the relationship between water temperature at a site and the drainage area above that site. Green Diamond has found that water temperatures are positively associated with drainage area and relatively predictable up to a size of approximately 10,000 acres. In drainages with greater watershed area, water temperatures tend to have increasingly greater variation probably in response to a variety of complex interacting physical factors (Beschta et al. 1987). To account for the relationship between water temperature and drainage area, 7-day highest mean water temperature (7DMAVG) was regressed on the square root of drainage area at locations known to support populations of southern torrent salamanders, tailed frogs or coho salmon. These three species were selected for the analysis because they are the most sensitive of the Covered Species to water temperature increases. The square root transformation was used to create a linear relationship between the two variables. Then, to establish a temperature threshold value, the upper 95% prediction interval (PI) of individual sample sites was used for drainages up to approximately 10,000 (100 square) acres. A prediction interval is based on the probability that a sample point will occur

within a specified interval. It should be noted that using the regression of water temperature versus drainage area to establish threshold values was only intended to apply to 4th order or smaller streams that generally occur in drainages less than 10,000 acres. As noted above, this is because the relationship gets weaker for increasingly larger watersheds. The temperature threshold is described as: water temperature = $14.35141 + 0.03066461 \times \text{square root watershed area}$.

A summary of each summer temperature profile which includes some of this information is presented in Appendix C5, along with a review of the literature on appropriate salmonid temperature thresholds (also see Section 4.3 and the HPA profiles in Sections 4.4).

3.3.1.3.2 Barriers

Barriers are channel features that have the effect of partially or completely impeding fish passage. They form as the result of natural occurrences and as a by-product of land uses in the watershed. Natural barriers, such as falls and gorges, are often the result of a watershed's geologic conditions; woody debris jams also occur naturally. Barriers result in separating resident populations and controlling the distribution of anadromous species over a broad range.

Barriers resulting from land uses typically occur when debris from logging related activities enters the stream channel (often triggered by a road or hillslope failure) or when culverts are placed in the channel at road crossings. Depending on where and when such debris accumulates, the barrier can compound the restrictions on fish passage that occur naturally, precluding access to or exit from stream niches.

Depending on placement and stream flow, culverts may act as partial or total barriers to fish migration. Improperly designed and installed culverts restrict the movement of juvenile salmonids as well as adults, thus potentially affecting the access to potential spawning habitat and overwintering survival of juvenile coho salmon, steelhead, and cutthroat trout that commonly seek refuge from winter flows in smaller streams. There are five common conditions at culverts that create barriers (Bates 1992):

- Excess drop at culvert outlet;
- High velocity within culvert barrel;
- Inadequate depth within culvert barrel;
- High velocity and/or turbulence at culvert inlet; and
- Debris accumulation at culvert inlet.

3.3.1.3.3 Smaller Watersheds

Along the Pacific Northwest coast, watersheds occupied by salmonids vary in size from tiny intermittent streams to the mainstem Columbia River. However, smaller watersheds (first to fourth order) are where the majority of spawning and rearing occurs in forested watersheds (Chamberlain et al. 1991). Coho salmon, steelhead, and coastal cutthroat trout in particular often seek out the smallest tributaries available for spawning.

Smaller watersheds also are important because of their influence on the quality of the habitat downstream. Sediments, woody debris, nutrients, and thermal radiation that enter the upper sections of a watershed can be transported downstream and directly affect the water quality and channel formation of downstream areas. In addition, smaller watersheds may be acutely responsive to alterations of their riparian zone vegetation and adjacent hillslopes. In this regard, a small watershed can serve as an important bellwether of habitat conditions for salmonids in a larger area.

3.3.2 Amphibian Habitat Characteristics

3.3.2.1 Stream and Channel Features

Stream habitat for the southern torrent salamander and tailed frog generally occurs upstream from salmonid habitat in the smaller headwater portions of streams with cold water and clean gravels and in seeps or springs. Compared to lower stream reaches, headwater streams tend to have higher gradients and more confined channels. In addition, immediate geological conditions tend to dictate channel morphology more than hydrological processes. Some of the habitat elements in headwater streams are not directly comparable to the lower fish-bearing reaches, but there are many similarities relevant to understanding the habitat requirements of the covered amphibians.

3.3.2.1.1 Pools

Pools, which are so important to many of the fish species, are of limited use to tailed frogs and are avoided by torrent salamanders. Pools are extensively used by the Pacific giant salamander which preys on all smaller amphibians and whose presence may preclude use of pool habitat by other amphibian species.

3.3.2.1.2 Riffles

Riffle habitats generally are the most important to torrent salamanders and the tadpoles (larvae) of tailed frogs. To be high quality habitat, the riffles must be composed of unembedded cobble and gravel with minimal amounts of sand and silt. The cobble and gravel provide interstices through which these amphibians can move to forage and escape predation. Tailed frog tadpoles are more likely to be found in lower gradient riffles in areas of greater stream flow (lower in the stream course), while torrent salamanders are more often found in riffles with higher gradient and lesser flow (uppermost portions of the stream channel). Low gradient riffles with minimal flow are good habitat for torrent salamanders if the substrate is not highly embedded. However, this condition is less likely to exist in disturbed areas or where there are naturally high background levels of sediment.

3.3.2.1.3 Seeps, Cascades, and Splash Zones

Seeps, which are probably the best habitat for the torrent salamander, are a special type of habitat in which there is minimal but rather constant flow of water through the substrate. Many seeps are occupied only by the torrent salamander, without the potential competing and predatory interactions of the Pacific giant salamander. This circumstance is the reason that the highest densities of torrent salamanders are commonly found in this habitat type. Tailed frog tadpoles are not found in seeps, but the

juvenile and adult frogs presumably forage and, in higher elevation areas, possibly overwinter in such habitat.

Cascade and splash zone habitats are also used by covered amphibians. Cascades of small headwater streams are likely used for foraging by adult tailed frogs and torrent salamanders; and both larvae and adults of both species are commonly found in splash zones where the streamside substrate stays constantly moist and cool.

3.3.2.1.4 Perennial and Intermittent Stream Flows

Streams with torrent salamanders and tailed frogs generally have perennial flow, but the flow may be intermittent with subsurface flow in some reaches. For example, in some of the low elevation coastal streams, tailed frog tadpoles that first emerge in October or November complete metamorphosis the following summer in late July or August. Tailed frog eggs are laid in summer, deep in the stream bed beneath logs, boulders or other coarse substrate and can be maintained by subsurface flow. Therefore, portions of the stream can appear dry with only subsurface flow during late summer and early fall, and support a viable population of tailed frogs. Torrent salamander larvae respire through gills and require more than one year to metamorphose, so they cannot persist in a stream that goes completely dry. However, similar to the eggs of tailed frogs, the larvae can survive in minimal amounts of subsurface water. As a result, a stream can give the appearance of being dry but still support a viable population of these salamanders.

3.3.2.2 Riparian Zone Contributions

The two covered amphibians have an additional dependency on the riparian zone relative to the covered anadromous fish species, because the adults of both amphibian species spend most of their time in this area. Both tailed frogs and southern torrent salamanders have limited dispersal abilities, and the juveniles and adults of both species spend most of their time in close proximity to the stream. Riparian vegetation provides the cover and maintains the cool moist microclimate that is essential to adults of both species. In addition, the riparian vegetation is necessary to maintain cold water temperatures required by the larvae of both species.

As with the fish Covered Species, the riparian zone is important to the covered amphibians as a source of large woody debris. Useful LWD can be smaller in headwater streams than in fish-bearing reaches because the stream channel is smaller and the energy of the water is less. However, its function is similar in both stream types in that LWD serves to store gravel and other sediments that create vital habitat. When clean cobble and gravel are sorted and stored in headwater streams by LWD, they allow water to percolate down through the coarse sediment, providing excellent amphibian habitat for escape cover, foraging, and egg laying.

3.3.2.2.1 Water Temperature

Brown (1975) found that the upper limiting temperature for tailed frog eggs was 18.5°C. The lethal thermal maximum for adult tailed frogs was reported to be 23-24°C (Claussen 1973). The preferred thermal range of tailed frogs in the Initial Plan Area is likely to be lower than either of these values, as Bury (1968), surveying in Northern California, found tailed frogs in streams with temperatures ranging from approximately 2 to 15.5° C, and Green Diamond personnel have observed a similar range (4-15° C).

Welsh and Lind (1996) determined that 17.2°C was the thermal stress threshold for southern torrent salamanders. Green Diamond personnel have observed southern torrent salamanders in streams with a mean water temperature of 12.5°C (SE = 0.25) and a range from 10°C to a maximum of 16°C, indicating that their preferred thermal range is substantially lower than their thermal stress threshold.

This page intentionally blank.